

FOREST PEST CONDITIONS

IN CALIFORNIA – 1999



A PUBLICATION OF THE CALIFORNIA FOREST PEST COUNCIL

THE CALIFORNIA FOREST PEST COUNCIL

The California Forest Pest Council, a 501(3)c non-profit organization, was founded in 1951 as the California Forest Pest Control Action Council. Membership is open to public and private forest managers, foresters, silviculturists, entomologists, pathologists, biologists, and others interested in the protection of forests from damage caused by biotic and abiotic agents. The Council's objective is to establish, maintain, and improve communication among individuals who are concerned with these issues. This objective is accomplished by five actions:

1. Coordinate the detection, reporting and compilation of pest damage, primarily forest insects, diseases and animal damage.
2. Evaluate pest conditions, primarily those of forest insects, diseases and animal damage.
3. Make recommendations on pest control to forest management, protection agencies and forest land-owners.
4. Review policy, legal and research aspects of forest pest management, and submit recommendations thereon to appropriate authorities.
5. Foster educational work on forest pests and forest health.

The California Board of Forestry recognizes the Council as an advisory body in forest health protection, maintenance and enhancement issues. The Council is a participating member in the Western Forest Pest Committee of the Western Forestry and Conservation Association.

This report, ***Forest Pest Conditions in California – 1999***, is compiled for public and private forest land managers and other interested parties to keep them informed of conditions on forested land in California, and as a historical record of forest insect and disease trends and occurrences. The report is based largely on information provided by three sources: (1) information generated by Forest Pest Management, Pacific Southwest Region, USDA Forest Service, while making formal detection surveys and biological evaluations, (2) reports and surveys of conditions on private lands provided by personnel of the California Department of Forestry and Fire Protection, and (3) the statewide Cooperative Forest Insect and Disease Survey, in which federal, state, and private foresters and land managers participate.

The report was prepared by the USDA-Forest Service, Pacific Southwest Region, State and Private Forestry, in cooperation with other member organizations of the Council, published by the California Department of Forestry and Fire Protection, and distributed by the two agencies.

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SUMMARY

Insects

Bark beetles. Tree mortality caused by bark beetles was not common in 1999. Other than scattered mortality on the Lassen National Forest and Lassen Volcanic National Park, and some mortality near Truckee and in the Lake Tahoe Basin, few instances of mortality or top-kill were reported.

Defoliators. Defoliators remained the most important group of insects on the forest scene. A new infestation of the Douglas-fir tussock moth appeared in northeastern California, but it now appears that the population has crashed and little defoliation should take place in 2000. The outbreak at Sequoia-Kings Canyon National Park and the Hume Lake District of the Sequoia National Forest continued, albeit at a lower intensity. The fruittree leaf roller was more abundant in the San Bernardino Mountains in Southern California and defoliation was the heaviest observed during the 1990s. The lodgepole pine needleminer caused more damage to lodgepole pine in Yosemite National Park. The Modoc budworm increased and feeding damage is easily visible in parts of the northern Warner Mountain District of the Modoc National Forest.

Heavy infestations of the red gum lerp psyllid can cause defoliation of its hosts and this exotic is spreading rapidly throughout the state on red gum, blue gum, sugar gum and a few other eucalyptus species.

Diseases

Tanoak and oak decline. Thousands of tanoaks and neighboring oaks died throughout coastal California from the Oregon border south to San Luis Obispo. The symptoms of tanoak decline vary, but typically the first symptom is branch wilt at the tip, followed by branch dieback. The branch resprouts but the sprouts also die. The necrotic area spreads into the stem and then the foliage turns brown but remains attached. Oak bark beetles and ambrosia beetles are often found associated with dead trees. The cause or causes of this widespread decline are not known.

Pitch canker. Pitch canker continues to spread in the native Monterey pine stands, prompting the California Native Plant Society to submit a petition to the State Fish and Game Commission to list Monterey pine as a state threatened plant species.

Pitch canker was reported for the first time in Napa County and a survey of several Northern California counties indicates pitch canker is not in Del Norte, Humboldt, Mendocino, Yolo and Sacramento Counties.

Concern about the spread of pitch canker heightened when it was discovered that bales of pine needles contaminated with *Fusarium circinatum* were imported to Truckee, California from Georgia. The bales were being used for erosion control and landscaping at a resort development. The discovery was made while checking the shipment for red imported fire ant.

Dwarf mistletoe and root disease. While not novel or spectacular, dwarf mistletoe and root disease are none-the-less noteworthy. These native pathogens continue to decrease growth and accelerate mortality throughout California's forests.

Abiotic. Dry summer conditions contributed to massive forest fires that killed trees on hundreds of thousands of acres throughout the state.

FOREST INSECT CONDITIONS – 1999

BARK and ENGRAVER BEETLES, and BORERS

CALIFORNIA FLATHEADED BORER, *Melanophila californica*. This borer continues to kill low numbers of drought-stressed, pole-sized and larger pines, particularly Jeffrey pine, in the mountains of Southern California (M262A and B).

CEDAR BARK BEETLES, *Phloeosinus* spp. Port-Orford-cedar of all size classes died along the Trinity River north of Trinity Lake, and also along Castle Creek above Castle Crags State Park. Cedar bark beetles were present in most of these trees. Flooding during January 1997 caused changes in the soil level in the root zone of the trees, or debris caused physical damage to the boles. Cedar bark beetles were also involved in a spot of Port-Orford-cedar mortality located along Clear Creek in the Siskiyou Wilderness. Port-Orford-cedar root disease was not involved in this mortality (M261A).

DOUGLAS-FIR BEETLE, *Dendroctonus pseudotsugae*. Douglas-fir beetle killed a small number of Douglas-fir near Hotelling Ridge, in southwestern Siskiyou County in 1999. Beetles apparently built up in trees damaged during storms in December 1995 (M261A).

FIR ENGRAVER, *Scolytus ventralis*. True fir mortality caused by the fir engraver continues to decline in northeastern California from the high rates characteristic of the drought years of the late 1980s and early 1990s. The following isolated white fir mortality was detected during aerial surveys in 1999: a small pocket near Saddleback Mountain on the Downieville District, Tahoe National Forest (M261E), a pocket on private land two miles south of Owl Lake near the Shasta National Forest (M261D), about 120 acres of scattered mortality just south of Rocky Peak near the southwest corner of Lassen Volcanic National Park (M261D), and a few spots of isolated mortality on the Lassen National Forest (M261D). The fir engraver continues to kill tops and branches of old-growth red and white fir in the Thousand Lakes Wilderness (M261D).

True fir mortality and top-kill associated with the fir engraver remained at background rates throughout much of the southern part of the Sierra Nevada Mountains (M261E). Fir engraver activity in white fir was seen near Spooner Junction, within the Lake Tahoe Basin in areas underburned in 1997, and in red fir south of Spooner Summit. Fir engraver caused scattered white fir mortality and top-kill northeast and west of Deer Meadow on the Hume Lake District, Sequoia National Forest.

Scattered white fir mortality continued in 1999 throughout the mixed-conifer type in southern California (M262B). Dead and dying trees were typically infected with white fir mistletoe, root and/or heart rot and roundheaded borers as well as the fir engraver, which is often the ultimate cause of death.

FIR ROUNDHEADED BORER, *Tetropium abietis*. Old-growth red and white firs are declining and slowly dying in the Thousand Lakes Wilderness (M261D). Fir roundheaded borer is usually present in the thick-barked portions of the boles of dead and dying firs.

JEFFREY PINE BEETLE, *Dendroctonus jeffreyi*. Jeffrey pine beetle activity peaked about three years ago in northeastern California and declined each year thereafter. Mortality of individual Jeffrey pines and groups of two to three trees was noted in 1999 in the Warner Valley and Drakesbad areas in Lassen Volcanic National Park (M261D). All size classes were attacked with no apparent pattern. Jeffrey pine beetle killed several old-growth Jeffrey pines along both the Bunchgrass and the Tamarack Swale Trails into the Thousand Lakes Wilderness. The number of trees killed appeared to be down from previous years (M261D). One pocket of mortality was detected on the Almanor District, Lassen National Forest (M261D) near Buzzard Springs, and some Jeffrey pine mortality was noted near Roxie Peconom Campground south of Highway 44 on the Eagle Lake Ranger District (M261E).

On the Tahoe National Forest, Jeffrey pine mortality continued in the southeast quadrant of the intersection of Highway 89 and Interstate 80. Small pockets of mortality have been noted in this area for several years (M261E).

Mortality associated with the Jeffrey pine beetle remained low in Southern California (M262A and B) and throughout most of the southern Sierra Nevada Mountains and foothills (M261E and F). Jeffrey pine beetle mortality was located east of June Lake on the Inyo National Forest (M261E). In the Lake

Tahoe Basin (M261E), pockets of Jeffrey pine beetle mortality were observed east of Meyers in the Lake Valley area and west of Eagle Rock in Blackwood Canyon. Jeffrey pine beetle activity was also noted near Spooner Junction on the east side of Lake Tahoe in areas that had been underburned in 1997.

MOUNTAIN PINE BEETLE, *Dendroctonus ponderosae*. Chronic areas of lodgepole pine mortality continued in 1999 on the Truckee District, Tahoe National Forest (M261E). Additional mortality occurred north of Truckee along Highway 89, near the Upper Little and Lower Little Truckee Campgrounds, near Silver Creek Campground and in the Squaw Valley area south of Truckee on Highway 89 toward Lake Tahoe.

Mountain pine beetle killed lodgepole pine in several areas on the Lassen National Forest (M261D). Low rates of mortality were detected on the north edge of the boundary with Lassen Volcanic National Park, on an area just south of Badger Mountain and one just north of Badger Flat, Hat Creek Ranger District. Within the park scattered lodgepole pine and western white pine continue to be attacked and about 10 percent of the lodgepoles are now dead in an area northeast of Emigrant Lake. Several areas of high lodgepole pine mortality continue to be evident northwest of Lassen Park in the Thousand Lake Wilderness: Magee Peak, Crater Peak, north of the Twin Lakes, near Barrett Lake, Hufford Lake and Eiler Butte. Pockets of mortality occur east of the Wilderness near Tamarack Swale and to the south in Bunchgrass Valley, near Huckleberry Meadows and along Forest Service System Road 32N36 south of Grayback Ridge. On the Plumas National Forest, several sugar pines that were scorched in the Bucks Fire (September 1999) are under attack by mountain pine beetle (M261E).

Mortality associated with the mountain pine beetle remained low in Southern California (M262A and B) and throughout most of the southern Sierra Nevada Mountains and foothills (M261E and F). Pockets of lodgepole pine mortality were reported on the Inyo National Forest (M261E) in the vicinity of the town of Mammoth Lakes —west of Twin Lakes, near Mill City and west of Old Mammoth. Mortality in lodgepole pine was also noted in the Lake Tahoe Basin (M261E) in the Washoe Meadows area west of Meyers and along Pioneer Trail east of the Tahoe airport.

PINE ENGRAVERS, *Ips* spp. *Ips confusus* continues to kill pines infected with black stain root disease in the San Bernardino Mountains. Other pine engravers, including *I. paraconfusus* and *I. pini*, infested slash and drought-stressed small to moderate diameter pines throughout the mountains of Southern California (M262A and B).

Attack by pine engravers was suspected in the top dieback of mature and over-mature ponderosa pines in the four corners area east of Burney, Shasta County (M261D). *Ips* were the apparent cause of mortality of pole-sized ponderosa pine growing on shallow, droughty soil south of McCloud, Siskiyou County (M261A).

PINE REPRODUCTION WEEVIL, *Cylindrocopturus eatoni*. Mortality from pine reproduction weevil continued in pine plantations on the Groveland District (Stanislaus National Forest) and the Mariposa District (Sierra National Forest) in 1999 but at reduced rates compared to 1997 and 1998 (M261E). Suppression (removal of infested trees) was conducted over about 577 acres on the Groveland District and 954 acres on the Mariposa District. Approximately half of the 3,343 acres surveyed on both districts had mortality related to the pine reproduction weevil.

RED TURPENTINE BEETLE, *Dendroctonus valens*. This bark beetle has been commonly found in prescribed burns in northeastern California over the past three years. Currently, it is not causing much mortality in this region with the exception of the Lost Creek area, which is south of Highway 44 and north of Lassen Volcanic National Park (M261D). Red turpentine beetle was abundant in a ponderosa pine plantation near the Everett Memorial Highway on Mt. Shasta that had been scorched in a prescribed burn in the spring of 1999 (M261D). Similarly, attacks of the red turpentine beetle were common on pines damaged by wildfire and prescribed burns in Southern California (M262A and B), but in general, populations were not high. No reports or observations of red turpentine beetle activity



Red turpentine beetle on Ponderosa pine after underburn. Photo by Dave Schultz, USDA Forest Service

were received from the southern part of the Sierra Nevada Mountains and foothills (M261E and F).

WESTERN PINE BEETLE, *Dendroctonus brevicomis*. Western pine beetle populations and associated mortality were low in Southern California (M262A and B) and the Sierra Nevada Mountains and foothills (M261E and F). Minor scattered overstory mortality was detected by aerial survey between Goat Mountain and Letts Lake (M261B). Mortality was restricted to scattered trees and small groups of ponderosa pine. In northern California, ponderosa pine mortality was generally light after five consecutive years of ample winter precipitation.

In northeastern California pockets of mortality were recorded but mortality was generally uncommon. Two pockets with moderate activity were detected near Dow Flat Campground on Forest Service Road 22 north of Eagle Lake, Lassen National Forest (M261G). In the Thousand Lakes Wilderness, Lassen National Forest, a small amount of ponderosa mortality was scattered over an area of about 600 acres west of Magee Peak (M261D). Also in M261D, but on the Shasta National Forest, two areas of ponderosa mortality were found near Long Valley Mountain and along Long Valley Creek one mile north of Lookout Mountain.

DEFOLIATORS

CALIFORNIA OAKWORM, *Phryganidia californica*. The California oakworm caused light to moderate defoliation of canyon live oak along the Trinity River on the Hoopa Reservation (M261A).

CALIFORNIA BUDWORM, *Choristoneura carnana californica*. Light feeding on white fir was visible for approximately 10 miles along the County Road on the east side of Trinity Lake from the old Trinity Guard Station site to the East Fork of the Trinity River. Defoliation was also noted on the Feeny Ridge Road and Feeny Gulch Road. On the west side of the lake, very light feeding was found near Trinity Center and the Swift Creek Road and along Bowerman Ridge (M261A). This is the fourth consecutive year of visible, but light defoliation of overstory trees and some scattered moderate to heavy defoliation on understory trees. The total area with visible feeding remained at approximately 5,000 acres. No growth loss or mortality is anticipated. A small sample at four locations found 13 egg masses per meter square of foliage.

DOUGLAS-FIR TUSSOCK MOTH, *Orgyia pseudotsugata*. In northeastern California, about 2,200 acres of Douglas-fir tussock defoliation were detected by aerial surveillance in August 1999 on the Big Valley District, Modoc National Forest (M261G). The defoliation is about half on National Forest land and half on privately owned land. Currently there are three distinct defoliated polygons near Upper Rush Creek, Manzanita Mountain and Deer Spring Ridge. High trap counts (male moths) were recorded in 1998 in the vicinity of the defoliation. Affected trees are about 10 to 20 percent defoliated. Intermediate and suppressed trees are more seriously defoliated. Egg mass surveys completed in November by the Forest Service and the California Department of Forestry found that populations have collapsed and little defoliation should be evident in 2000.

In 1998, Douglas-fir tussock moth populations reached outbreak on white fir in locations on the Sequoia National Forest and Sequoia-Kings Canyon National Parks (M261E). These populations declined in 1999 due to natural factors without causing significant additional damage. Larval feeding injury was largely restricted to the current year's growth and was most evident on white fir growing in areas that suffered moderate to heavy defoliation, but little to no damage, in 1998.

FALL WEBWORM, *Hyphantria cunea*. The fall webworm fed heavily on madrone for the past two years in a number of locations in the Klamath Mountains (M261A). Some trees have been completely stripped of foliage. Specific locations include: along the Klamath River near Happy Camp, along Highway 299 from Lewiston to Willow Creek, along Highway 3 near the Stuart Fork of the Trinity River, and Dead Horse Ridge south of Harrison Gulch on Highway 36. The combination of feeding from fall webworm, several madrone leaf spot diseases which were abundant during the past two wet springs, and madrone canker has raised concerns about possible mortality of individual ornamental madrones. Defoliation and conspicuous webbing on individual and small groups of madrone were evident in several isolated locations in Tuolumne and Calaveras counties (M261F).

FRUITTREE LEAFROLLER, *Archypis argyrospila*. The end of the century marked the heaviest defoliation of California black oak in Southern California in the 1990s. Defoliation varied from light (less than 10% of the crown) to severe (more than 75% of the crown defoliated). Defoliation was particularly

heavy near the Heaps Peak Arboretum in the San Bernardino Mountains, where the affected stand resembled a “ghost forest.” Moderate defoliation occurred in Angelus Oaks and on portions of the north slope of the San Bernardino Mountains, and there was moderate to heavy defoliation around Lake Gregory and along the Rim of the World Drive. Defoliation was light on ridge tops and at higher elevations. No defoliation was observed at Barton Flats (all M262B).

GYPSY MOTH, *Lymantria dispar*. Thirteen adult male gypsy moths had been trapped by Pest Detection, California Department of Food and Agriculture. The trap catches by county were: Contra Costa 1, Los Angeles 2, Nevada 3, San Diego 2, San Mateo 5. Trap densities around these finds were increased from three traps per square mile to 25 traps per square mile. No properties with egg masses or pupal cases were found in 1999.

LODGEPOLE PINE NEEDLEMINER, *Coleotechnites milleri*. Lodgepole needleminer populations continued to increase in several areas of Yosemite National Park (M261E). High populations were present at Tenaya Lake Basin, Cathedral Lake, Delaney Creek, Olmstead and May Lake. Populations were also high at Budd Creek, but this area also showed high rates of parasitism by *Copidosoma* sp. Defoliation was very evident at May Lake, Tenaya Gap, the Cathedral Lake Basin and the upper Budd Creek area. Population densities remained low around the high use areas of Tuolumne Meadows, but there are extensive areas of visible defoliation to lodgepole pine both north and south of Tuolumne Meadows and along the Pacific Crest, John Muir and High Sierra Loop trails.

MODOC BUDWORM, *Choristoneura retiniana*. The Modoc budworm increased its presence throughout the northern portion of the Warner Mountain District, Modoc National Forest (M261G). The areas most notably affected are North Star Basin, the Mill Creek and Cottonwood watersheds, and a large area surrounding Del Pratt Springs. Damage is limited to the consumption of the new foliage on white fir. Approximately 50% of the trees in most stands have signs of feeding in the top four feet of the tree as well as the tips of all lateral branches.

MOURNINGCLOAK BUTTERFLY, *Nymphalis antiopa*. Larval feeding caused light to heavy defoliation on willow growing in, and in the vicinity of, the meadow immediately adjacent to Grant Grove Village in Sequoia National Park (M261E).

PINE NEEDLESHEATH MINER, *Zelleria haimbachi*. The abundance of pine needlesheath miner increased on ponderosa pine east of Ponderosa, Siskiyou County (M261D). A spring survey found an average of 3.8 larval mines per shoot, compared with 1.9 and 0.9 mines per shoot in 1998 and 1997 and 9.4 mines per shoot during the outbreak year of 1994. Defoliation caused by the miner was moderate.

SATIN MOTH, *Stilpnotia salicis*. The satin moth caused heavy defoliation of aspen near Little Shasta Meadow west of Ball Mountain for the second year (M261D). A small green leafroller present that superficially resembles the fruit tree leafroller may have contributed to the damage.

SEQUOIA PITCH MOTH, *Synanthedon sequoiae*. A heavy infestation of what appears to be Sequoia pitch moth was widespread on hundreds of trees over 10 acres of an isolated stand of low elevation ponderosa pine along Paynes Creek, Tehama County (M261F). Approximately 10% of the trees show severe decline with poor needle retention and thin crowns.

OTHERS

AFRICANIZED HONEY BEE, *Apis mellifera scutellata*. The known colonized area for the Africanized honey bee in Southern California greatly expanded in 1999 to include all of San Diego, Orange, Los Angeles, San Bernardino, Riverside, and Imperial Counties, the southern part of Ventura County, and the western portion of Kern County. Africanized bees have also been identified from collections of foraging bees west of Lake Isabella, and near Loma Park and Lebec, California. The Loma Park find is the first in the Central Valley. These identifications were based on mitochondrial DNA analyses and not on bee behavior. On September 11, 1999, the first human fatality in California, and the eighth nationally, occurred in Long Beach. An 83-year-old man was stung at least 50 times while mowing his lawn and subsequently died (261B, M262B, 322A,B, and C). The current distribution of the Africanized honey bee can be found on the internet at www.cdfa.ca.gov/pests/honeybee/california.html.

BALSAM TWIG APHID, *Mindarus abietinus*. This aphid caused needle stunting and twig distortion of white fir over 5,000 to 10,000 acres on the Hume Lake District (Sequoia National Forest) and the Sequoia-Kings Canyon National Parks (M261E). Much of the area affected coincided with areas that had received moderate to heavy defoliation by the Douglas-fir tussock moth between 1997 and 1999. Twisted needles on new growth of white fir were also widespread on the Modoc and Lassen National Forests (M261G and D).

REDGUM LERP PSYLLID, *Glycaspis brimblecombei*. This insect has become widespread in California since its discovery at two locations in 1998 — El Monte in Los Angeles County and Ardenwood Preserve in Alameda County. The psyllid now occurs in Alameda, Los Angeles, Napa, Orange, Riverside, San Bernardino, San Diego, San Mateo and Santa Clara Counties. Solano County can be added to the list as the psyllid has been found on Mare Island near the Regional Office of the Pacific Southwest Region, USDA-Forest Service. The primary host is red gum, but some other eucalyptus species are also hosts. Heavily infested trees are partially defoliated. In addition to defoliation, the insect is a nuisance because of the honeydew it secretes and the fallen leaf litter. In Southern California, red gum has been extensively planted, including on National Forest System administrative sites (261A and B). Fortunately red gum is resistant to the eucalyptus longhorned borer, another introduced pest.

A detailed discussion of this new eucalyptus pest may be found in the following: California Department of Food and Agriculture. California Plant Pest and Disease Report . 18(1-2):1-3. Information on current biocontrol research at the University of California at Berkeley may be found by an internet search of "redgum lerp psyllid."

Table 1. Miscellaneous Reports of Forest Insects in California, 1999

Insects		Where Examined or Reported		
Common Name	Scientific Name	Host	County	Remarks
Amethyst cedar borer	<i>Semanotus amethystinus</i>	Port-Orford-cedar	Siskiyou (M261A)	Dunsmuir, in residential area.
Elm leaf beetle	<i>Xanthogaleruca luteola</i>	Elm	Lassen	Many defoliated trees in Susanville and along Hwy 395.
Fall webworm	<i>Hyphantria cunea</i>	Fruit trees	Siskiyou	Abundance caused defoliation in vicinity of Happy Camp, CA
Giant conifer aphid	<i>Cinara</i> sp.	White fir	Trinity, Siskiyou (M261A)	Scott Mtn. and Big Flat Campgrounds; visible foliage curling
Pine needle-sheath miner	<i>Zelleria haimbachi</i>	Ponderosa pine	Modoc (M261G)	Plantation in Warner Mountains
Red turpentine beetle	<i>Dendroctonus valens</i>	Coulter pine	Angeles (M262B)	A nonhost being girdled by numerous attacks.
Spruce aphid	<i>Elatobium abietina</i>	Sitka spruce	Humboldt (263A)	Chronic infestation of planted trees along Hwy 1 s. of Eureka.
White fir sawfly	<i>Neodiprion</i> spp.	White fir	Lassen	Widespread in lower crowns
Yellow jackets	<i>Vespula</i> spp.	—	Amador, Calaveras, Mariposa, Tuloumne	Nuisance, M261E and F.

FOREST DISEASE CONDITIONS – 1999

ABIOTIC DAMAGE

Fire. Wildfire was a serious mortality agent in Northern and Southern California in 1999. The Willow Fire, which burned over 63,400 acres from August 29 to September 4 on the north side of the San Bernardino National Forest, was the largest wildfire in the San Bernardino Mountains in 80 years, while the Kirk Complex Fires on the Monterey District of the Los Padres National Forest burned over 85,500 acres. The latter fires ignited September 8 and burned more than seven weeks. Tree mortality associated with fire damage and attacks by bark beetles will be monitored over the next few years. The Big Bar Complex of fires west of Redding burned for 2 months, scorching over 137,800 acres.

Frost. Growing tips on California black oaks were killed by an early June frost in several areas, including cold spots in organizational campgrounds above Cuddy Valley on the Los Padres National Forest, and Barton Flat and Banning Canyon on the San Bernardino National Forest (M262A and B).

Ozone. Forest Pest Management, Pacific Southwest Region established 26 ozone monitoring plots on the Sierra National Forest (M261E) in 1977. All of the plots are located between 4,000 and 8,000 feet in elevation and have been visited biennially over the past 22 years. Compared to 1997 when these sites were last visited and rated for chlorotic mottle in needles of ponderosa and Jeffrey pine, 10 showed no change in injury, 15 showed increased injury and one had less injury in 1999. Although some of the changes in plot ratings from two years ago were small, it is unusual for so many plots to experience an increase in foliar symptoms.

The general trend in ozone injury over the past two decades has been that plots at the lower elevations (4,000 to 5,000 feet) show the greatest amount of chlorotic mottle which has gradually become worse over time. Plots at the higher elevations (7,000 to 8,000 feet) show the least amount of injury and have changed very little since 1977.

Water. Flooding continued to cause lodgepole pine mortality around Hog Flat and McCoy Reservoirs, Lassen County (M261D). In addition, about 20 large Jeffrey pines were killed by a change in the water table near Willow Creek along Highway 70, Plumas County. Red turpentine beetles were associated with the mortality in these flooded trees.

Recent winter floods eroded stream banks and moved stream channels west of Susanville. This buried or damaged roots of some nearby trees. As a result, five Jeffrey pine with diameters greater than 40 inches and 20 smaller pines died along a 500 foot stretch of Willard Creek about one mile south of Highway 36 (M261D).

Wind. About 700 acres of blowdown were reported on the Doublehead District, Modoc National Forest (M261D). Main stems were broken and uprooted. Species affected include red fir, white fir and lodgepole pine. The blowdown is in the Medicine Lake Highlands area between Glass Mountain Geologic Area and Burnt Lava Flow Geologic Area. About 25 to 50 percent of the trees over the 700 acres were affected.

CANKER DISEASES

CYTOSPORA CANKER, caused by *Cytospora abietis*. Cytospora blight is typically found in association with infections of true fir dwarf mistletoe in red and white fir, where it causes moderate to severe branch flagging. In 1999, the disease was widespread and severe near South Fork Mountain on the Shasta-Trinity and Six Rivers National Forests (M261B), near Trapper Creek on the Goosenest District, Klamath National Forest (M261D), and at Dry Lake Mountain, north of the old Oak Knoll Ranger Station, on the Klamath National Forest (M261A). The disease was also noted near Cronney Ridge (Grindstone District, Mendocino National Forest, M261B), and at Trail Creek, Carter Meadows and Hidden Horse Campgrounds, Klamath National Forest (M261A).

Cytospora canker caused conspicuous branch flagging in white fir north of the Kaiser Wilderness between West Kaiser and Sample Meadow Campgrounds (M261E) on the Sierra National Forest. Almost

all dead branches were infected with white fir dwarf mistletoe. Affected trees were 18 to 24 inches dbh with light to moderate Hawksworth dwarf mistletoe ratings. In most cases, branch flagging accounted for 10 percent of the live crown.

DIPLODIA BLIGHT OF PINES, caused by *Sphaeropsis sapinea* (*Diplodia pinea*). Diplodia blight was widespread in low elevation (1,000 to 2,500 ft.) ponderosa pine stands at numerous locations in northern California, including the Sacramento River Canyon from Mountain Gate M261C) to Dunsmuir (M261A), and near Trapper Creek on the Goosene District, Klamath National Forest (M261D). Wet spring weather during shoot elongation caused an increase in infections and shoot dieback.

The disease appeared suddenly in several southern Sierra Nevada locations (M261E) in 1999. Locations with blight included San Jose and Berkeley organizational camps along Highway 120 west of Yosemite National Park; two sites near El Portal, two sites on the eastern portion of Lake Don Pedro and at the Pacific Ranger District office on the Eldorado National Forest.

Elevations at these locations varied from 900 feet at Lake Don Pedro to 3,500 feet at Berkeley Camp and the Pacific District office. Ponderosa pine was the host at all locations except for Lake Don Pedro, where gray pine was infected. Severity of infection also varied tremendously. In some trees only one or two branches were affected while in others 90 percent of the live crown was killed in one year. To date, none of the trees, regardless of infection severity, has died.

PITCH CANKER, caused by *Fusarium circinatum*. The total number of California counties infested with pitch canker increased to 19. A summer detection survey in north coast counties by the California Department of Forestry and Fire Protection found the disease for the first time in Napa County (263A). Pitch canker was also found in Marin and Sonoma Counties but not in Del Norte, Humboldt, Mendocino, Yolo and Sacramento counties. Other northern CA counties will be surveyed next year.

The isolated infestation of pitch canker at a Christmas tree farm near Dixon (Solano County, 262A) has persisted in spite of the removal of all visibly infected trees. It is unclear how the fungus is spreading on site since the infections are in the tree tops. Ground level infections and contaminated soil are typical at other Christmas tree farms.

Concern about the spread of pitch canker heightened when it was discovered that bales of pine needles contaminated with *Fusarium circinatum* were imported to Truckee, California from Georgia. The bales were being used for erosion control and landscaping at a resort development. The discovery was made while checking the shipment for red imported fire ant.

Monterey pines in Cambria and Año Nuevo were inoculated with the pitch canker fungus as part of a cooperative project lead by the California Department of Forestry to identify resistant trees. Branch lesion development at the site of inoculation indicates the degree of resistance. Putatively resistant trees as well as infected trees, which serve as controls, were tested. The tests will be repeated and the most promising trees cloned and grown for further suitability tests.

In August, the California Native Plant Society submitted a petition to the State Fish and Game Commission to list Monterey pine as a state threatened plant species. The petition discusses pitch canker as a major threat to the native stands along the Central California Coast (261A). The Commission will make a ruling on the completeness of the petition and then has a year to evaluate the request and make a decision.

BRANCH CANKER OF PONDEROSA PINE, cause unknown. Branch cankers were observed on approximately 30 ponderosa pines at the seed orchard of the Chico Genetic Resource Center, Butte County (262A). Branch mortality was generally light (less than 5%).

FOLIAGE DISEASES

ELYTRODERMA DISEASE, caused by *Elytroderma deformans*. Elytroderma disease from recent "wave-year" infections continues to damage ponderosa and Jeffrey pines near the west shore of Lake Almanor (M261D). Thirty to forty-year-old pine plantations in the area contain some of the heaviest infestations. Up to 75 percent of the branches have been killed and mortality in the lower crown has left

some pines with live crown ratios of 10 percent or less. Infections have contributed to the death of some over-topped trees in the plantations.

Elytroderma was also observed on ponderosa pine on the west and northwest sides of Snow Mountain, Shasta County (M261D) at elevations of roughly 4,000 to 5,000 feet. The disease was generally heaviest within drainages, such as Little Cow and Montgomery Creeks, but was not limited to these areas. Trees of all ages were infected. A small percentage of trees were heavily infected but few showed evidence of chronic infection, i.e. brooming and poor needle retention.

TARSPOT OF MADRONE, caused by *Rhytisma punctatum*. Tarspot of madrone was observed in a number of locations in the Klamath Mountains, including along the Klamath River near Happy Camp, along Highway 299 from Lewiston to Willow Creek, along Highway 3 near the Stuart Fork of the Trinity River and Dead Horse Ridge south of Harrison Gulch on Highway 36 (M261A).

TRUE FIR NEEDLE CAST, caused by *Lirula abietis*. True fir needle cast was observed on white fir near the USDA-Forest Service White Cloud Station off Highway 20, Nevada County (M261E).

ROOT DISEASES

ANNOSUS ROOT DISEASE, caused by *Heterobasidion annosum*. While the incidence of black stain root disease on ponderosa pine decreased at McCloud Flats (M261D), the incidence of annosus root disease increased in 1999. The disease was confirmed in white fir near Trapper Creek, in ponderosa pine and juniper in the Rainbow Compartment (Goosenest District, Klamath National Forest, M261D), in white fir near Bear Mountain (Mount Shasta District, Shasta-Trinity National Forest, M261D), and in red and white fir in several stands near Croney Ridge (Grindstone District, Mendocino National Forest, M261B). Annosus root disease was also identified as a factor affecting management at Kangaroo Lake, Trail Creek and Carter Meadows campgrounds on the Scott River District of the Klamath National Forest (M261A). Confirmation of the disease was made by locating fruiting bodies of the fungus inside of stumps. Downed red and white fir with decayed roots and recent and older mortality, were also present at the sites. Several annosus root disease centers were also confirmed in white fir in the Willard Creek drainage east of Fredonyer Pass, Lassen County (M261E).

BLACK STAIN ROOT DISEASE, caused by *Leptographium wageneri*. Black stain root disease was found in Douglas-fir trees at Benjamin Creek, southwest of Happy Camp (M261A) and in ponderosa pines in a mixed-conifer stand near Slate Mountain, east of Clair Engle Lake (M261A). The disease was also identified in a Douglas-fir at Indian Scotty Campground (Scott River District, Klamath National Forest, M261A). Seven black stain root disease centers were also identified in Douglas-fir north of Lyonsville, Tehama County (M261D). Hundreds of trees have died over many years.

In surveys conducted during the spring and summer of 1999, incidence of black stain root disease was found to have decreased dramatically in thinned ponderosa pine stands in various areas of McCloud Flats (M261D).

PHYTOPHTHORA ROOT DISEASE, caused by *Phytophthora* spp. The USDA-Forest Service, Chico Genetic Resource Center Container Nursery lost less than 5 percent of their Douglas-fir, ponderosa pine and white fir seedlings to phytophthora root rot in 1999 (262A).

PORT-ORFORD-CEDAR ROOT DISEASE, caused by *Phytophthora lateralis*. Fish Lake Creek was resurveyed from Blue Lake to below Fish Lake for the presence of dying Port-Orford-cedars (Orleans District, Six Rivers National Forest, M261A). Although the incidence and impacts of the disease have increased markedly since the last survey in 1997, indicators of infection have not appeared below the outlet of Fish Lake. However, the disease has spread to another drainage into Fish Lake near Red Mountain Lake Trail. The disease has not spread further along Bluff Creek Road. New areas of Port-Orford-cedar infestation were confirmed at Alder Conservation Camp and Golden Bear RV Park near Klamath (263A), at Shasta Retreat in Dunsmuir and at three new locations near the river bank along the Sacramento River south of Dunsmuir (M261A). At the *P. lateralis* site on Bear Creek Road in Dunsmuir, a few isolated infected trees are dying in a residential neighborhood next to a small brook that empties directly into the river. All trees in the area are expected to die, but trees along the river above and below the site appear healthy.

RUST DISEASES

WESTERN GALL RUST, caused by *Endocronartium harknessii*. High numbers of western gall rust infections were identified at the Dry Lake area of McCloud Flats (McCloud District, Shasta-Trinity National Forest) and on mature pines on Hearst Corporation property south of McCloud, Siskiyou County (M261D). Diplodia blight is also affecting the trees.

WHITE PINE BLISTER RUST, caused by *Cronartium ribicola*. Minor amounts of white pine blister rust were observed in western white pine at Kangaroo Lake Campground (Scott River District, Klamath National Forest, M261A).

Blister rust was prominent on sugar pine seedlings and saplings between Wishon Reservoir and the Kings River on the Sierra National Forest (M261E). Most of the rust was found between 6,000 and 7,000 feet. Tree and branch mortality were common from infections dating to the early 1990s. Branch mortality and topkill on sugar pine were observed north of the Kaiser Wilderness. Affected trees were widely scattered at elevations between 5,500 and 7,000 feet.

White pine blister rust was not found during surveys of the Tehachapi Mountains, the Los Padres National Forest or the Angeles National Forest. The known southern extent of the disease remains at Breckenridge Mountain on the Sequoia National Forest.

YELLOW WITCHES BROOM, cause by *Melampsorella caryophyllacearum*. Numerous and conspicuous witches brooms were present southeast of Lake Tahoe in Alpine County (M261E). Although this location is in California, it is part of the Toiyabe National Forest. The rust was affecting dozens of red fir at an elevation of 8,000 feet.

TRUE MISTLETOES

INCENSE-CEDAR TRUE MISTLETOE, caused by *Phorodendron juniperinum* f.sp. *juniperinum*. Minor amounts of incense-cedar true mistletoe were noted at Juanita Lake Campground, Goosenest District, Klamath National Forest (M261D).

DWARF MISTLETOES

DOUGLAS-FIR DWARF MISTLETOE, caused by *Arceuthobium douglasii*. Scattered Douglas-fir infected with Douglas-fir dwarf mistletoe were identified at Trail Creek Campground, at the group camp at Indian Scotty Campground (Scott River District, Klamath National Forest, M261A), and at Juanita Lake Campground (Goosenest District, Klamath National Forest, M261D).

RED FIR DWARF MISTLETOE, caused by *Arceuthobium abietinum*, f.sp. *magnificae*. Incidence and impact of red fir dwarf mistletoe continues to be heavy at South Fork Mountain (Shasta-Trinity and Six Rivers National Forests, M261B) and at Dry Lake Mountain (Scott River District, Klamath National Forest, M261A). The disease has also been identified as a concern affecting management at Trail Creek, Carter Meadows and Hidden Horse Campgrounds (Scott River District, Klamath National Forest, M261A). Damage by both red fir and white dwarf mistletoes is increased by branch mortality, caused by *Cytospora abietis*, associated with the dwarf mistletoe infections, as well as by topkill and mortality caused by the fir engraver beetle (*Scolytis ventralis*).

WESTERN DWARF MISTLETOE, caused by *Arceuthobium campylopodum*. Moderate levels of western dwarf mistletoe were observed at the Dry Lake area of McCloud Flats (McCloud District, Shasta-Trinity National Forest, M261D). Scattered ponderosa pines infected with western dwarf mistletoe were identified at Juanita Lake Campground (Goosenest District, Klamath National Forest, M261D).

WHITE FIR DWARF MISTLETOE, caused by *Arceuthobium abietinum* f.sp. *concoloris*. Incidence and impact of white fir dwarf mistletoe continues to be heavy at South Fork Mountain (Shasta-Trinity and Six Rivers National Forests, M261B), near Trapper Creek (Goosenest District, Klamath National Forest, M261D), and at Dry Lake Mountain (Scott River District, Klamath National Forest, M261A). The disease has also been identified as a concern affecting management at Trail Creek, Carter Meadows and Hidden Horse Campgrounds (Scott River District, Klamath National Forest, M261A).

DECLINES

ASPEN DECLINE, cause unknown. Quaking aspen on the Warner Mountain District, Modoc National Forest (M261G) are exhibiting symptoms of insect and disease activity. Some clones appear to have considerable amounts of defoliation by feeding insects. The specific insect or pest complex has yet to be determined. Small stands affected by defoliation are distributed across the district. Most of the quaking aspen stands also exhibit signs of false tinder fungus. In many stands, false tinder fungus appears to be a chronic problem for many years until the host trees die and the clone eventually disappears.

HACKBERRY DECLINE, cause unknown. For the past 8 to 10 years, mature hackberry in Davis (Yolo County, 262A) have been declining and dying. Typically the declining trees are about 45 years old, surrounded by lawn, and irrigated frequently. Examination of tree tops, root crowns, and roots show evidence of tree failure only in the roots and root crown. The first symptom of the decline is off-color foliage on one or several branches high in the canopy. As the decline continues, off-color foliage increases in the canopy, followed by branch dieback. The tree dies within four to six years after the first symptoms are apparent. A causal agent has not been recovered, nor have any insects been observed.

In declining trees, the root crown is discolored at the tree base. The affected wood has a strong, distinct “anchovy” odor. Only the root crown and roots are affected. Wood at the soil line is very dark, almost black, in an irregular pattern corresponding to affected roots below. The cambium is killed in areas with discoloration. Some roots are affected while others appear to be healthy. The stain does not extend higher than the root crown and fine roots are not visibly affected. As roots die and the tree declines, living roots can no longer support the tree’s physiological needs and it dies.

LODGEPOLE PINE DECLINE, cause unknown. Mature lodgepole pine north of Cone Lake, around McCoy Flat Reservoir, and along Road A21 north of Westwood, Lassen County (M261D) are showing signs of decline. Short needles, thin crowns and lower branch mortality are common on overstory lodgepole pines over 100 years of age. Some of the pines are infected with dwarf mistletoe, but old age and competition from understory trees are suspected as major causes of the decline, no pathogen has been identified thus far.

TANOAK AND OAK DECLINE, cause unknown. Thousands of tanoak and neighboring oaks have died throughout coastal California from the Oregon border south to San Luis Obispo. The symptoms of tanoak decline vary but typically the first symptom is branch wilt at the tip, followed by branch dieback. The branch resprouts but the sprouts also die. The necrotic area spreads into the stem and then the foliage turns brown but remains attached to the branches. Oak bark beetles and ambrosia beetles are often found associated with dead trees. The cause or causes of this widespread decline are not known.

In 1999, dieback of tanoak was observed at Mt. Tamalpais and Muir Woods National Monument in Marin County (263A), on private lands in Santa Cruz County (261A), along the Bluff Creek Road between Blue Lake and Onion Mountain (Orleans District, Six Rivers National Forest, M261A), near Grouse Mountain (Lower Trinity District, Six Rivers National Forest, M261B), and along the Bald Hills Road in Redwood National Park (263A). (See Special Report.)

SPECIAL REPORT

Tanoak/Live Oak Decline

Bruce Hagen

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The tanoak/live oak problem has all the appearances of a classic decline disorder. Such disorders typically involve adverse environmental conditions (drought, saturated soils, inordinately wet springs, etc.) or biotic factors (disease, competition, etc.) that cause physiological stress. Tree declines, which may suddenly emerge over wide areas, often trigger lethal attack by secondary insects or pathogens. Declines characteristically abate when environmental conditions become more favorable or stressed

trees are killed. In the absence of abiotic and biotic stresses, secondary pests, common in the ecosystem, are generally unable to overcome trees' natural host resistance.

The Pest Complex

At least two insects and two pathogens are associated with the tanoak/live oak deaths. Anthracnose-like symptoms, e.g., leaf spotting, necrosis, shoot blight, and canker-like symptoms (dead patches of innerbark and cambium with stained sapwood) have been observed in the tanoaks. Fruiting bodies of *Hypoxylon thourarsianum* are associated with many dead tanoaks and live oaks.

The western oak bark beetle and the oak ambrosia beetle, both indigenous, secondary pests, are commonly associated with the dead and dying trees. Due to the large number of suitable host trees, the bark beetle and ambrosia beetle populations have skyrocketed. It is quite possible that the unusually high population of oak bark beetles is solely responsible for some of the tree mortality. As with other bark beetles, repeated attacks can eventually overcome natural resistance. Disease is not always a prerequisite for bark beetle attack. Stressful environmental conditions alone may predispose trees to attack, particularly if the population is at outbreak levels. Ambrosia beetles are less likely to kill trees, in most cases; they colonize trees already attacked by oak bark beetle or those that have died recently. Their success is largely dependent on the moisture level of the wood they attack.

Investigators have detected *Armillaria* root disease on some of the dead and dying trees which can predispose them to secondary attack by the bark beetles. The fact that *Hypoxylon thourarsianum* is often associated with the dead and dying trees suggests that this pathogen may also be a critical factor in the mortality. Various species of *Hypoxylon* have been involved as secondary pathogens in widespread declines of oaks in the southern and eastern United States. *Hypoxylon* species can colonize healthy trees and remain dormant until the host tree is sufficiently weakened.

Recent climatic events that may be contributing to the current outbreak include: a severe drought from 1987 to 1993, and two excessively wet ("El Niño") years occurring back to back. Drought-stress weakens natural defenses, predisposing trees to secondary pests. Wet years favor the development of leaf and shoot diseases (anthracnose), which can further weaken natural defenses. Saturated soils in mid-to-late spring also undoubtedly affected root development and depressed root function. Thus, secondary pests, which normally cause little damage to healthy trees, could colonize and kill weakened trees.

Another contributing factor may be the decline of the overall health of the tanoak and live oak stands. Much of the land where the tanoaks and oaks are now growing was cleared by early settlers: logged of redwood and fir then used for grazing and agriculture. Other stands regenerated from stump sprouts. Thus the present trees are growing on the original root systems, which are declining. The current forest is significantly different than it once was. Fire has been excluded from much of the area for more than 50 years. The trees are crowded, competition is high, and root disease is common. In urban areas, oak tree health has been impacted by construction, overpruning, incompatible landscaping, frequent irrigation, etc. It is no wonder that many urban trees have been affected by the decline.

Heavy mortality of both tanoak and coast live oaks has been observed in Marin and Santa Cruz Counties. Significant mortality is occurring in Sonoma County particularly in the tanoaks but many live oaks have been reported killed as well. There are also reports of tanoaks deaths from San Mateo, Lake, Mendocino and other California counties.

This is a potentially serious pest problem because it is impacting urban trees as well as native stands. Loss of property values, and environmental and wildlife benefits could be significant. Furthermore, there is a significant increase in the risk of wildfire due to the many dead trees, particularly the dead understory trees.



Dying tanoak in Marin County. Photo by Bruce Hagen, CDF.

SURVEYS AND EVALUATIONS - 1999

WHITE PINE BLISTER RUST RESISTANCE SCREENING PROGRAM - FY-1999

Progeny of 805 sugar pine trees were grown, inoculated, and evaluated for major gene resistance (MGR) to white pine blister rust at the greenhouses located at the Placerville Nursery. One hundred seven new resistant families were identified from this evaluation bringing the total number of MGR trees in the program to 1,293.

For the next cycle of screening, progeny of 809 sugar pine trees were grown and inoculated and are ready to be evaluated for MGR. An additional 101 families of western white pine and 2 families of whitebark pine were sown in 1998 and are now ready to be inoculated and evaluated for blister rust resistance.

In the spring of 1999, 2,982 proven MGR seedlings were planted at the Happy Camp site for long-term evaluation. A total of 6,778 sugar pine seedlings from the 1989 and 1991 plantings were evaluated for multi-gene blister rust resistance mechanisms. In addition, a 1996 planting of 141 foxtail pine were evaluated for rust resistance.

THE 1999 COOPERATIVE DOUGLAS-FIR TUSSOCK MOTH PHEROMONE DETECTION SURVEY

Average trap catches of male Douglas-fir tussock moths (DFTM) for 1999 showed decreases for several plots compared to 1998 catches (Table 2, Page 14). Data were collected for 159 plots (5 traps/plot) during 1999. Of these, 151 plots (95%) had fewer than an average of 25 males per trap. The eight plots (5%) that averaged more than 25 moths per trap were located on the following Ranger Districts: Mt. Hough, Plumas National Forest; Almanor, Lassen National Forest; Big Valley, Modoc National Forest. In addition to these plots on National Forests, three plots on private land monitored by the California Department of Forestry averaged more than 25 moths per trap.

Light to moderate defoliation was detected on 2,200 acres of private and public lands in the vicinity of Manzanita Mountain, Deer Spring Ridge and in the Calpines area, Modoc County. Elevated trap counts were noted for these areas in 1998. However, fluctuations in trap counts are very common with DFTM populations. Egg mass surveys were conducted in November 1999 to assist in predicting DFTM population levels in the defoliated and surrounding areas for 2000. The absence of egg masses indicates that the population has collapsed under natural controls and continued defoliation in these areas is not anticipated in 2000.

Although significant activity by DFTM is not anticipated within other areas monitored by the plot system during 2000, field-going personnel are urged to continue to monitor for evidence of feeding and defoliation on white fir throughout the susceptible host type this coming summer and fall. Federal and state forest pest management personnel will continue to monitor all life stages at established monitoring sites and in the areas where DFTM activity exceeded an average of 25 males per trap. Forest managers may want to consider establishing additional pheromone plots in areas of susceptible host type. Personnel at the offices listed on the reverse of the Forest pest Detection Report form at the end of this document can provide further information of program participation.

DEMONSTRATION THINNING PLOTS IN THE EASTSIDE PINE TYPE ON THE LASSEN NATIONAL FOREST. In 1978-1979 the Forest Service established plots in the eastside pine type to show the effects of thinning on pest-caused losses in areas of high tree mortality. The stands chosen were mostly pole-size ponderosa pine mixed with some white fir and incense-cedar, growing on medium to low sites, and ranging in age from 70 to 90 years. Within the demonstration plots, four levels of stocking density — 40, 55, 70 and 100 percent of normal basal area — were established to demonstrate the biological and economic alternatives available for management planning. (Normal basal area is the basal area that a stand should have reached when fully stocked with trees, which in the demonstration areas, ranges from 185 to 215 sq ft/ac, depending on site quality.) Twenty years after thinning, the treatments had reduced mortality from 95 to 100 percent of the level in unthinned stands (Table 3).

TABLE 2. Number of Pheromone Detection Survey Plots for Douglas-fir Tussock Moth in 1999 and the Average Male Moth Catch per Trap.

Year	Total Plots	No. of Plots with an average Moth Catch per Trap of:													
		0<10	10<20	20<25	25<30	30<35	35<40	40<45	45<50	50<55	55<60	60<65	65<70	70<75	75+
1979	102	97	2	1	1	0	1	0	0	0	0	0	0	0	0
	100%	95%	2%	1%	1%		1%	-	-	-	-	-	-	-	-
1980	99	99	0	0	0	0	0	0	0	0	0	0	0	0	0
	100%	100%	-	-	-	-	-	-	-	-	-	-	-	-	-
1981	93	78	10	4	1	0	0	0	0	0	0	0	0	0	0
	100%	84%	10%	4%	2%	-	-	-	-	-	-	-	-	-	-
1982	95	93	1	0	1	0	0	0	0	0	0	0	0	0	0
	100%	98%	1%		1%	-	-	-	-	-	-	-	-	-	-
1983	98	87	6	1	1	3	0	0	0	0	0	0	0	0	0
	100%	89%	6%	1%	1%	3%	-	-	-	-	-	-	-	-	-
1984	111	51	18	11	5	7	8	4	3	4	0	0	0	0	0
	100%	46%	16%	10%	4%	6%	7%	4%	3%	4%	-	-	-	-	-
1985	105	58	14	4	7	6	5	1	2	4	1	2	0	1	0
	100%	55%	13%	4%	7%	6%	5%	1%	2%	4%	1%	2%	0	1%	-
1986	107	64	16	4	8	6	1	3	0	1	0	1	1	1	1
	100%	60%	16%	3%	7%	6%	1%	3%	-	1%	-	1%	1%	1%	1%
1987	108	80	15	4	2	1	1	3	0	1	0	0	1	0	0
	100%	74%	14%	4%	2%	1%	1%	2%	-	1%	0	0	1%	-	-
1988	124	105	9	3	3	0	2	1	0	0	0	0	0	0	0
	100%	86%	7%	2%	2%	-	2%	1%	-	-	-	-	-	-	-
1989	130	129	1	0	0	0	0	0	0	0	0	0	0	0	0
	100%	99%	1%	-	-	-	-	-	-	-	-	-	-	-	-
1990	138	135	1	0	1	1	0	0	0	0	0	0	0	0	0
	100%	97%	1%	-	1%	1%	-	-	-	-	-	-	-	-	-
1991	143	135	4	1	0	0	2	1	0	0	0	0	0	0	0
	100%	94%	3%	1%	0	0	1%	1%	-	-	-	-	-	-	-
1992	164	156	3	0	2	1	0	0	0	0	1	0	1	0	0
	100%	95%	1%	-	1%	1%	-	-	-	-	1%	-	1%	-	-
1993	143	135	8	0	0	0	0	0	0	0	0	0	0	0	0
	100%	94%	6%	-	-	-	-	-	-	-	-	-	-	-	-
1994	151	139	11	1	0	0	0	0	0	0	0	0	0	0	0
	100%	92%	7%	1%	-	-	-	-	-	-	-	-	-	-	-
1995	158	77	35	13	16	7	7	3	0	0	0	0	0	0	0
	100%	49%	22%	8%	10%	4.5%	4.5%	2%	-	-	-	-	-	-	-
1996	149	33	26	16	8	7	12	9	5	8	6	8	5	1	5
	100%	22%	17%	11%	6%	4%	8%	6%	3%	6%	4%	6%	3%	1%	3%
1997	142	88	27	10	9	4	3	0	0	1	0	0	0	0	0
	%	62	19	7	6	3	2	-	-		-	-	-	-	-
1998	159	81	22	11	9	6	3	10	7	5	2	1	1	1	0
	100%	51%	14%	7%	6%	3%	2%	6%	4%	3%	1%	<1%	<1%	<1%	-
1999	159	126	20	5	3	2	2	0	0	0	1	0	0	0	0
	100%	79%	13%	3%	2%	1%	1%	-	-	-	1%	-	-	-	-

TABLE 3. Commercial Tree Mortality by Stocking Level, 20 years after thinning

Residual Stocking After Thinning

Year	40%	55%	70%	100%
	Trees per Acre			
1980	0.0	0.2	0.2	2.4
1981	0.0	0.0	0.7	2.4
1982	0.0	0.5	0.3	3.6
1983	0.0	0.1	0.8	4.1
1984	0.0	0.0	0.0	1.0
1985	0.0	0.2	0.0	0.6
1986	0.0	0.0	0.0	1.3
1987	0.0	0.0	0.0	1.4
1988	0.0	0.0	0.0	0.0
1989	0.0	0.4	0.0	2.6
1990	0.0	0.0	0.0	2.6
1991	0.0	0.0	0.0	1.8
1992	0.0	0.2	0.0	3.0
1993	0.0	0.2	0.3	5.2
1994	0.0	0.0	0.0	4.8
1995	0.0	0.0	0.3	0.4
1996	0.0	0.2	0.0	1.3
1997	0.0	0.2	0.0	1.3
1998	0.0	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.9
Mean	0.0	0.1	0.1	2.0
Range	0	0-0.5	0-0.8	0-5.2
Percent Mortality Reduction Compared with normal Basal Area				
		100	95.0	95.0

a. Commercial trees are 8 inches dbh and larger, with straight boles, yielding at least one 10-foot log with a 6-inch top. Trees were killed by the mountain pine beetle.

b. Percent of normal basal area.

LANDCOVER CHANGES IN DETECTING VEGETATION CALIFORNIA USING SATELLITE IMAGERY—Southern California Project Area Summary

The USFS and CDF have been cooperating on a statewide change detection program covering California over five-year period using satellite imagery. The state is divided into 5 project areas. The goal of the program is to implement a long-term, low cost monitoring program to identify trends in forest health and assess changes in vegetation extent and composition. A two-phased approach is used to a) describe broad landscape changes between two points in time, and b) determine the causes of those changes. Changes are derived from two dates of satellite imagery. Causes of change are attributed in a GIS from ancillary data and fieldwork. The south coast project area encompasses approximately 20 million acres in private, federal, military and city/county level ownership.

Approximately 17 acres of change fell within the 41-100% canopy cover increase class while 20,838 acres fell within the 16-40% decrease canopy cover class. The majority of vegetation change, 145,896 acres, fell in the shrub decrease class. An accuracy estimate conducted on the landcover change map produced 89% overall accuracy. Causal information is currently being collected. Analysis will focus

on urban/wildland development and impacts on forest resources and overall forest health. Current information can be accessed on the Internet at <http://frap.cdf.ca.gov>.



Table 5. 10 Categories of landcover change classes were mapped and evaluated ranging from 71-100% canopy cover loss to 41-100% canopy cover increase, a shrub increase and decrease class, and vegetation change within existing urban.

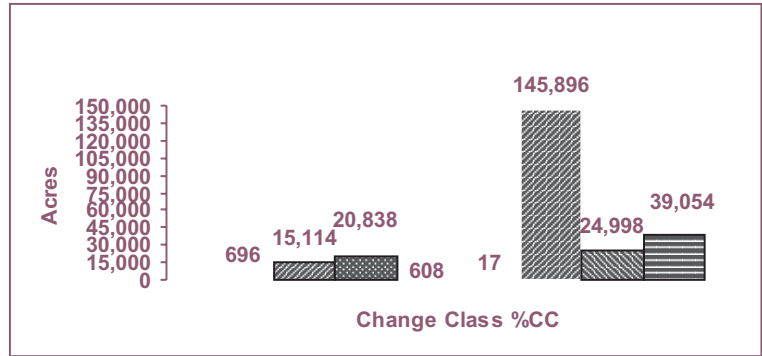


TABLE 6. AERIAL OBSERVATION OF ACRES WITH MORTALITY, DEFOLIATION AND BLOWDOWN IN CALIFORNIA, 1999 ¹

Damage	Pines	Douglas-fir/true fir	Hardwoods	Total
Mortality	17,844	15,256	0	33,100
Defoliation	0	76,451	0	76,451
Main stem broken or uprooted	0	762	0	762
1. Forested acres flown and observed - 22,540,360				

LIST OF COMMON AND SCIENTIFIC NAMES

INSECTS

Common Name	Scientific Name
Bark Beetles	
California fivespined engraver	<i>Ips paraconfusus</i>
Cedar bark beetles	<i>Phloeosinus</i> spp.
Douglas-fir beetle	<i>Dendroctonus pseudotsugae</i>
Fir engraver	<i>Scolytus ventralis</i>
Jeffrey pine beetle	<i>Dendroctonus jeffreyi</i>
Mountain pine beetle	<i>Dendroctonus ponderosae</i>
Pine engraver	<i>Ips pini</i>
Pine engravers	<i>Ips</i> spp.
Pinyon ips	<i>Ips confusus</i>
Red turpentine beetle	<i>Dendroctonus valens</i>
Western pine beetle	<i>Dendroctonus brevicomis</i>
Defoliators	
California budworm	<i>Choristoneura carnana californica</i>
Douglas-fir tussock moth	<i>Orgyia pseudotsugata</i>
Elm leaf beetle	<i>Xanthogaleruca luteola</i>
Fall webworm	<i>Hyphantria cunea</i>
Fruittree leafroller	<i>Archips argyrospilus</i>
Gypsy moth	<i>Lymantria dispar</i>
Lodgepole pine needleminer	<i>Coleotechnites milleri</i>
Modoc budworm	<i>Choristoneura retiniana</i>
Mourningcloak butterfly	<i>Hymphalis antiopa</i>
Satin moth	<i>Stilanolia salicis</i>
White fir sawfly	<i>Neodiprion</i> spp.
Tree Regeneration Insects	
Balsam twig aphid	<i>Mindarus abietinus</i>
Giant conifer aphid	<i>Cinara</i> sp.
Pine needlesheath miner	<i>Zelleria haimbachi</i>
Pine reproduction weevil	<i>Cylindrocopturus eatoni</i>
Other	
Africanized honey bee	<i>Apis mellifera scutellata</i>
an encyrtid wasp	<i>Copidosoma</i> sp.
Amethyst cedar borer	<i>Semanotus amethystinus</i>
California flatheaded borer	<i>Melanophila californica</i>
Eucalyptus longhorned borer	<i>Phoracantha semipunctata</i>
Redgum lerp psyllid	<i>Glycaspis brimblecombei</i>
Roundheaded fir borer	<i>Tetropium abietis</i>
Sequoia pitch moth	<i>Synanthodon sequoiae</i>
Spruce aphid	<i>Elatobium abietina</i>
Yellow jacket	<i>Vespula</i> Spp.

DISEASES AND THEIR CAUSAL PATHOGENS

Common Name of the Disease	Scientific Name of the Pathogen
Cankers	
Branch canker of pine	unknown
Cytospora canker	<i>Cytospora abietis</i>
Diplodia blight of pines	<i>Sphaeropsis sapinea</i> (<i>Diplodia pinea</i>)
Pitch canker	<i>Fusarium circinatum</i>
Phomopsis canker	<i>Diaporthe lokoyae</i>
Sclerophoma canker of pines	<i>Sclerophoma</i> sp.
Declines	
Lodgepole pine decline	unknown
Tanoak decline	unknown
Aspen decline	unknown
Dwarf Mistletoes	
Douglas-fir dwarf mistletoe	<i>Arceuthobium douglasii</i>
Red fir dwarf mistletoe	<i>Arceuthobium abietinum</i> f.sp. <i>magnificae</i>
True fir dwarf mistletoe	<i>Arceuthobium abietinum</i>

Western dwarf mistletoe
White fir dwarf mistletoe

Arceuthobium campylopodum
Arceuthobium abietinum f.sp. *concoloris*

Foliage Diseases

Elytroderma needle disease
Tarspot of madrone

Elytroderma deformans
Rhytisma punctatum

Root Diseases

Annosus root disease
Black stain root disease
Phytophthora root disease
Port-Orford-cedar root disease

Heterobasidion annosum
Leptographium wageneri
Phytophthora spp.
Phytophthora lateralis

Rusts

Western gall rust
White pine blister rust
Yellow witches broom

Peridermium harknessii
Cronartium ribicola
Melampsorella carpophyllacearum

True Mistletoe

Incense-cedar true mistletoe
White fir mistletoe
Trunk Rot
False tinder fungus

Phoradendron juniperinum f.sp. *juniperinum*
Phoradendron pauciflorum

Phellinus igniarius

TREES

Common Name

Scientific Name

Conifers: Pines

Gray pine
Jeffrey pine
Knobcone pine
Lodgepole pine
Monterey pine
Ponderosa pine
Singleleaf pinyon
Sugar pine
Western white pine
Whitebark pine

Pinus sabiniana
Pinus jeffreyi
Pinus attenuata
Pinus contorta var. *murrayana*
Pinus radiata
Pinus ponderosa
Pinus monophylla
Pinus lambertiana
Pinus monticola
Pinus albicaulis

True firs

Red fir
White fir

Abies magnifica
Abies concolor

Others

Douglas-fir
Incense-cedar
Port-Orford-cedar

Pseudotsuga menziesii
Libocedrus decurrens
Chamaecyparis lawsoniana

Hardwoods

Eucalyptus
Blue gum
Red gum
Sugar gum

Eucalyptus globulus
Eucalyptus camaldulensis
Eucalyptus cladocalyx

Oaks

Canyon live oak
California black oak
Oaks

Quercus chrysolepis
Quercus kelloggii
Quercus spp.

Other

Aspen
Elm
Hackberry
Tanoak
Willow

Populus tremuloides
Ulmus sp.
Celtis occidentalis
Lithocarpus densiflorus
Salix sp.

PUBLICATIONS

Owen, D. and D. Adams. 1999. Overview of pitch canker in California. In Devey, M.E., Matheson, A.C., and Gordon, T.R. eds. Current and potential impacts of pitch canker in radiata pine. Proceedings, IMPACT Monterey Workshop, Monterey, CA, USA, 30 November to 3 December. 1998. CSIRO Australia, Forestry and Forest Products Technical Report 112. 120 p.

Hagen, B. 1999. New pests threaten urban eucalyptus. Tree Notes Number 24, November 1999. 5 p.

FOREST PEST DETECTION REPORT

I. FIELD INFORMATION (See instructions on reverse)

1. County:		2. Forest (FS only):		3. District (FS only):	
4. Legal Description: T. _____ R. _____ Section (s) _____		6. Location: UTM: _____		7. Landownership: National Forest <input type="checkbox"/> Other Federal <input type="checkbox"/> State <input type="checkbox"/> Private <input type="checkbox"/>	
5. Date:		9. Size of Trees Affected:		10. Part(s) of Tree Affected:	
1. Insect <input type="checkbox"/> 5. Chemical <input type="checkbox"/> 2. Disease <input type="checkbox"/> 6. Mechanical <input type="checkbox"/> 3. Animal <input type="checkbox"/> 7. Weed <input type="checkbox"/> 4. Weather <input type="checkbox"/> 8. Unknown <input type="checkbox"/>		1. Seedling <input type="checkbox"/> 4. Sawtimber <input type="checkbox"/> 2. Sapling <input type="checkbox"/> 5. Overmature <input type="checkbox"/> 3. Pole <input type="checkbox"/>		1. Root <input type="checkbox"/> 5. Twig <input type="checkbox"/> 2. Branch <input type="checkbox"/> 6. Foliage <input type="checkbox"/> 3. Leader <input type="checkbox"/> 7. Bud <input type="checkbox"/> 4. Bole <input type="checkbox"/> 8. Cone <input type="checkbox"/>	
11. Species Affected:		12. Number Affected:		13. Acres Affected:	
14. Injury Distribution: 1. Scattered <input type="checkbox"/> 2. Grouped <input type="checkbox"/>		15. Status of Injury: 1. Decreasing <input type="checkbox"/> 2. Static <input type="checkbox"/> 3. Increasing <input type="checkbox"/>			16. Elevation:
17. Plantation? 1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>		18. Stand Composition (species):		19. Stand Age and Site Class:	
20. Stand Density:			21. Site Quality:		
22. Pest Names (if known) and Remarks (symptoms and contributing factors):					
23. Sample Forwarded: 1. Yes <input type="checkbox"/> 2. No <input type="checkbox"/>		24. Action Requested: 1. Information only <input type="checkbox"/> 2. Lab Identification <input type="checkbox"/> 3. Field Evaluation <input type="checkbox"/>		25. Reporter's Name:	
				26. Reporter's Agency:	
27. Reporter's Address and Phone Number:					
II. Reply (Pest Management Use)					
28. Response:					
29. Report Number:		30. Date:		31. Examiner's Signature:	

The Cooperative Forest Pest Detection Survey is sponsored by the California Forest Pest Council. The Council encourages federal, state, and private land managers and individuals to contribute to the Survey by submitting pest injury reports and samples in the following manner:

Federal Personnel: Send all detection reports through channels. Mail injury samples with a copy of this report to one of the following appropriate offices:

USDA Forest Service
State and Private Forestry
1323 Club Drive
Vallejo, CA 94592

Forest Pest Management
Shasta-Trinity National Forests
2400 Washington Avenue
Redding, CA 96001

Forest Pest Management
Stanislaus National Forest
19777 Greenley Road
Sonora, CA 95370

Forest Pest Management
Lassen National Forest
2550 Riverside Drive
Susanville, CA 96130

Forest Pest Management
San Bernadino National Forest
1824 Commercenter Circle
San Bernadino, CA 92408-3430

State Personnel: Send all detection reports through channels. Mail injury samples with a copy of this report to one of the following appropriate offices:

Forest Pest Management
CA Dept. of Forestry & Fire Protection
P.O. Box 1590
Davis, CA 95617

Forest Pest Management
CA Dept. of Forestry & Fire Protection
6105 Airport Road
Redding, CA 96002

Forest Pest Management
CA Dept. of Forestry & Fire Protection
17501 North Highway 101
Willits, CA 95490

Private Land Managers and Individuals: Send all detection reports and samples to the closest California Department of Forestry and Fire Protection office listed above.

Completing the Detection Report Form

Heading (Blocks 1-7): Enter all information requested. In Block 6, **LOCATION**, provide sufficient information for the injury center to be relocated. If possible, attach a location map to this form.

Injury Description (Blocks 8-15): Check as many boxes as are applicable, and fill in the requested information as completely as possible.

Stand Description (Blocks 16-21): This information will aid the examiner in determining how the stand conditions contributed to the pest situation. In Block 18 indicate the major tree species in the overstory and understory. In Block 19, indicate the stand age in years and/or the size class (seedling-sapling; pole; young sawtimber; mature sawtimber; overmature or decadent).

Pest Names (Block 22): Write a detailed description of the pest or pests, the injury symptoms, and any contributing factors.

Action Requested (Block 24): Mark "Field Evaluation" only if you consider the injury serious enough to warrant a professional evaluation. Mark "Information Only" if you are reporting a condition that does not require further attention. All reports will be acknowledged and questions answered on the lower part of this form.

Reply (Section II): Make no entries in this block; for examining personnel only. A copy of this report will be returned to you with the information requested.

Handling Samples: Please submit injury samples with each detection report. If possible, send several specimens illustrating the stages of injury and decline. Keep samples cool and ship them immediately after collection. Send them in a sturdy container, and enclose a completed copy of the detection report.

Your participation in the Cooperative Forest Pest Detection Survey is greatly appreciated. Additional copies of this form are available from the Forest Service, Forest Pest Management, and from the California Department of Forestry and Fire Protection.

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